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(54) Electric liquid-heating apparatus

(57) An electric liquid heating apparatus comprises a bell-shaped outer housing (10), a body (20) covered by the housing (10), a plurality of anodes (61) mounted on a longitudinal shaft (70) rotatable within the body, a plurality of cathodes (51) mounted on the inner wall of the body (20) and an adjustable device (80) mounted on the central portion of the top of the housing (10). The distance overlap between the anodes (61) and the cathodes (51) can be adjusted by rotating the longitudinal shaft (70) by a lever (40) and the distance between the anodes (61) and cathodes (51) can be adjusted by moving the longitudinal shaft (70) vertically by rotating device (80).

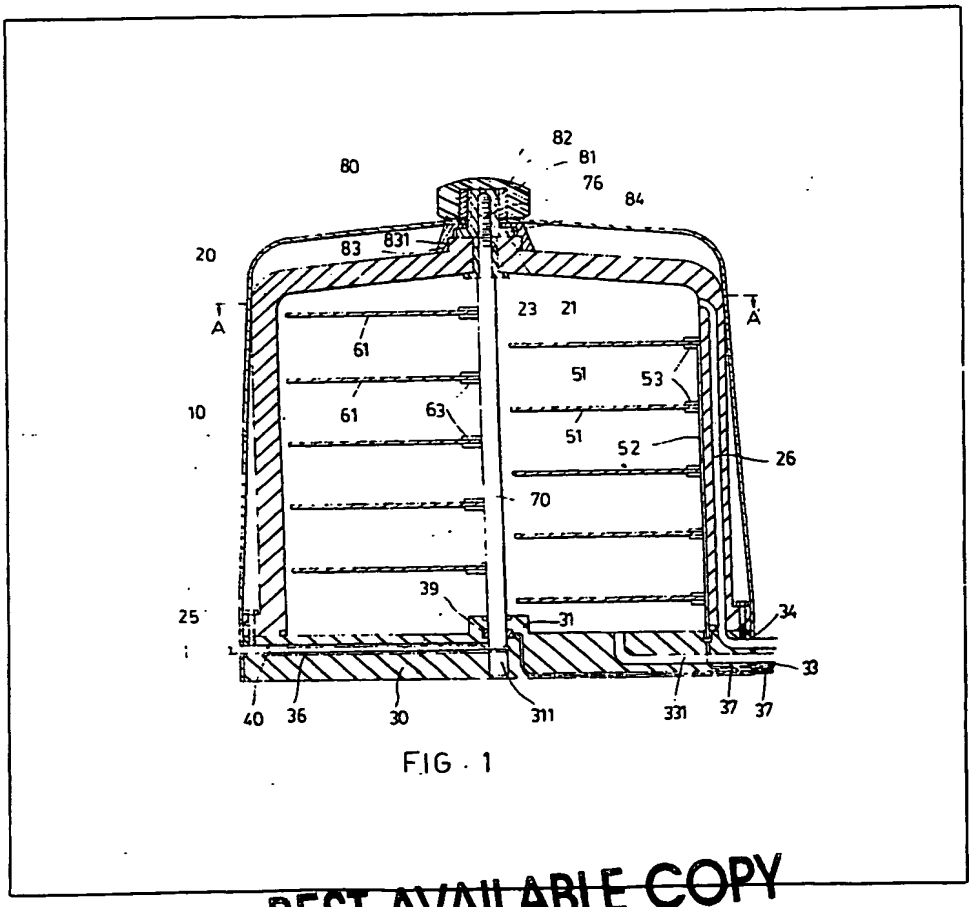

FIG. 1

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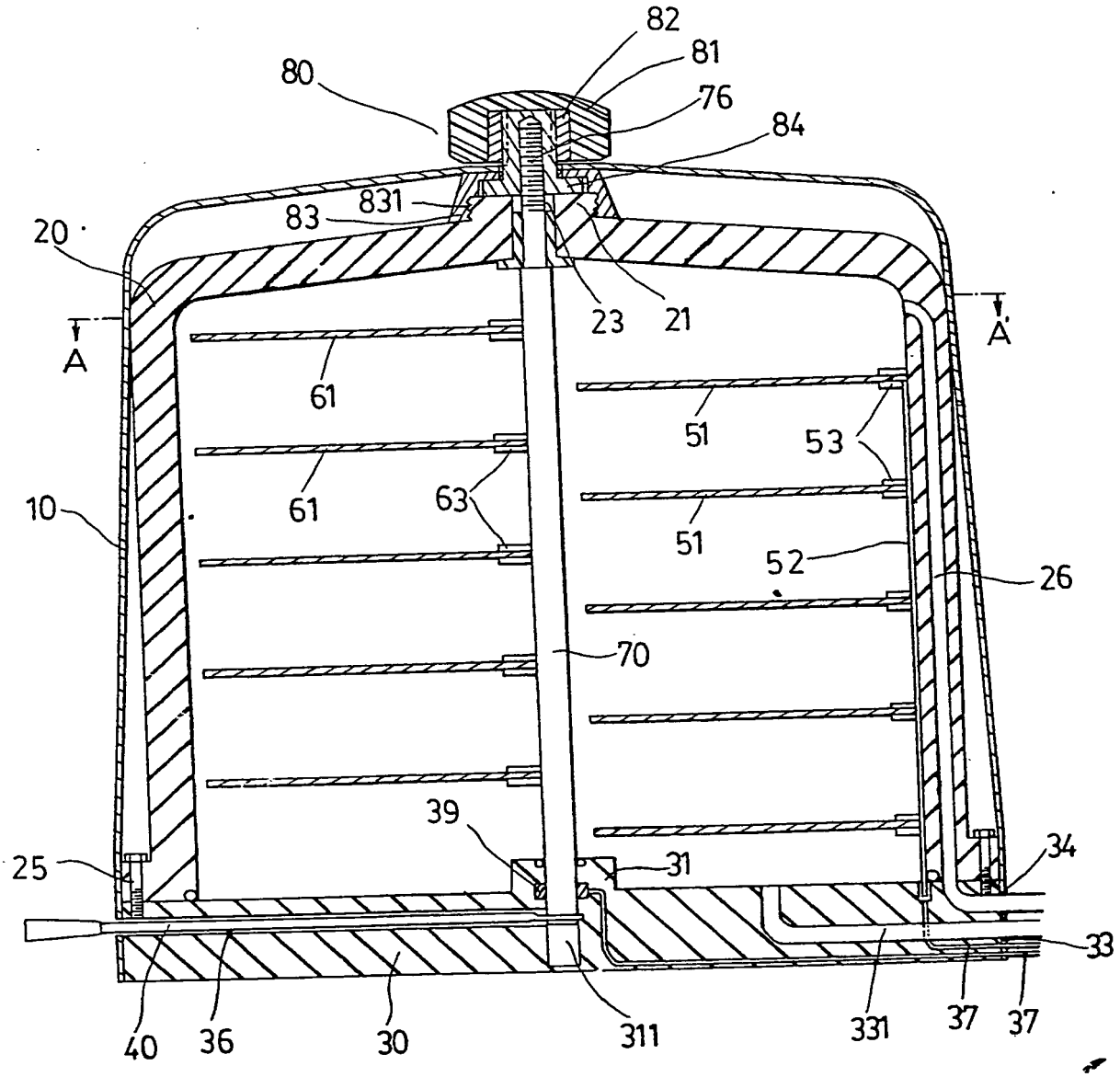
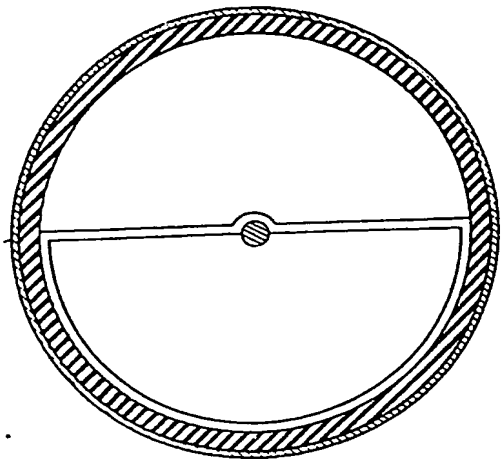


FIG. 1



SECTION A-A'

FIG. 3

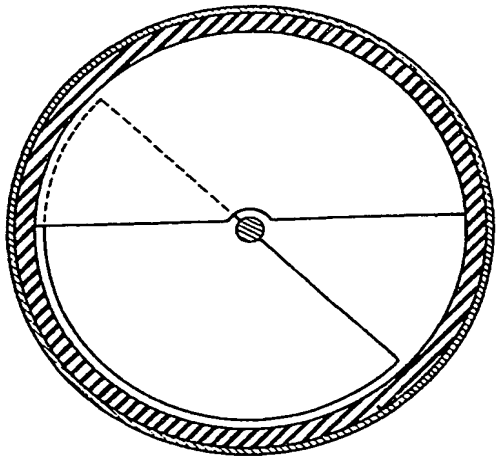


FIG. 4

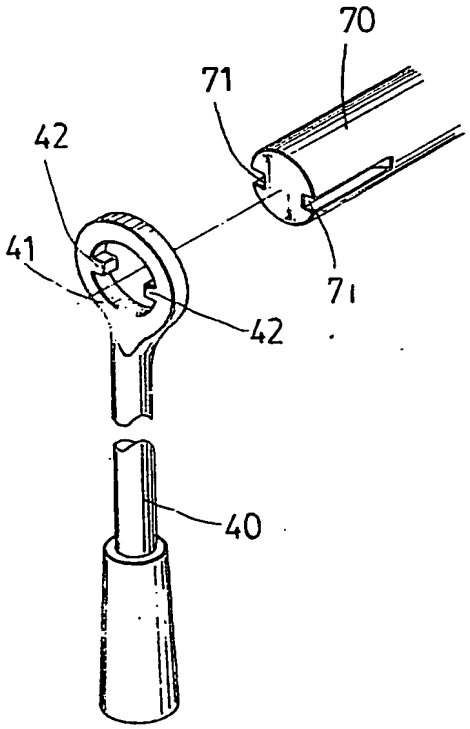


FIG. 2

SPECIFICATION

Electric heating apparatus for liquids

This invention relates to an improvement on the liquid heating equipments and more particularly, to an electric heating apparatus which has simple construction and provides low damage possibilities, in which the temperature of liquid, such as water, is adjustable.

Most conventional electric heating apparatus for liquid generally include switching joints and resistors of metal wire. They are easily damaged due to sparking, overheating or loosening occured on the switching joints during the operation. Furthermore, the adjustable range of temperature of the liquid heated by the known apparatus is relatively narrow, thus it is difficult to be used widely. Although some conventional heating apparatus utilize resistant of liquids to act as a resistor to heat the liquid therein, satisfied result for adjusting the temperature of the heated liquid can not be acquired.

The applicant has been engaged in manufacture and repairing of such known electric heating apparatus for many years and therefore knows the disadvantages the conventional heat apparatus very well.

Accordingly, it is an object of the present invention to provide an electric heating apparatus comprising means for adjusting temperature of the liquid without any switching joint or resistor. In other words, it provides a reliable, safe and economic electric heating apparatus for liquids.

It is another object of the present invention to provide a heating apparatus in which the distance between the corresponding anode and cathode can be adjusted to change the resistant of the liquid therebetween.

It is still another object of the present invention to provide an electric heating apparatus in which over-lapping area of each pair of the corresponding anode and cathode can be adjusted if desired.

These together with other objects and advantages of the present invention will become apparent in the details of construction and operation as more fully hereinafter described and claimed, reference being made to the accompanying drawings forming a part thereof.

Figure 1 is a sectional view of a preferred embodiment in accordance with the invention;

Figure 2 is a partial perspective view of an adjusting rod and a rotatable shaft illustrating the engaging relationship between the shaft and rod;

Figure 3 is a schematic sectional view taken substantially along the lines A–A′ of Fig. 1 in which anodes are not fully over-lapped or staggered with the cathodes thereof; and

Figure 4 is an another schematic sectional view taken substantially along the line A–A′ of Fig. 1 in which anodes are partially overlapped or staggered with cathodes.

Referring now to Fig. 1, there is shown a vertical sectional view of a preferred embodiment of the present invention comprising a bell-shaped outer housing 10, a main body 20 covered by the housing 10, a base 30 having a traversed semi-circular space 36 therein for receiving an adjusting rod 40 which can be moved horizontally for 180° in the space 36, two connects 38 and 39 for mounting a connecting plate 52 and a rotatable shaft 70 respectively, and an adjustable device 80 mounted on the tops of the outer housing 10 and the body 20 and engaged with the upper portion of the rotatable shaft 70.

The main body 20 is made of insulated materials such as fiber glass and has an inverted U-shaped sectional form. Provided on the center portion of the top of the main body 20 is a protuberance 21 having a through way 23 therein through which the upper portion of the rotatable shaft 70 is extended. At the lower end of the main body 20 is provided with a flange 25 through which screw bolts can be screwed into the base 30 so as to fix the body 20 to the base 30 integrally. At the upper portion of the body 20 is provided with a pipe 26 communicating with an outlet 34 provided in the base 30.

The base 30 is also made of insulated materials such as fiber glass in which the connects 38 and 39 are previously embedded. At the central portion of the base 30 is provided with a protuberance 31 having a cylindrical recess 311 therein for receiving the lower end of the rotatable shaft 70. The cylindrical recess 311 communicates with the traversed semi-circular space 36. The connect 39 is provided in the recess 311 and designed in intimate contact with the outer surface of the lower portion of the rotatable shaft 70 whenever the shaft is rotated or moves a certain distance in the vertical direction. Provided in the base 30 is an inlet 33 communicating with a pipe 331 which is connected to the water source (not shown).

Fig. 2 shows the adjusting rod 40 having an annular portion 41 provided at one end thereof, the annular portion 41 being provided with two catch pawls 42. At the outer surface of the lower portion of the rotatable shaft 70 are provided with two opposing longitudinal slots 71 for receiving the corresponding catch pawls 42 respectively. Thus, the shaft 70 can be rotated for an angle of 180° when the adjusting rod 40 is driven from one end to the other end of the semi-circle space 36.

Turning now to Fig. 1, the rotatable shaft 70 is made of conducting materials such as copper, copper alloy or the like, and has an upper portion 75 having a smaller diameter and an external screw 76 thereon. A plurality

of electrodes, acting as anodes 61, are mounted firmly on the rotatable shaft 70 and arranged in parallel to each other in the horizontal direction. The upper surface of the anodes 61 are coated with an insulated, waterproof and thermal resistant film so that the lower surface of the anodes 61 is the only conducting area after the rotatable shaft 70 is energized. And at the supported end of the anodes 61 is provided with packing members 63 made of insulated materials. A plurality of stationary electrodes, acting as cathodes 51, mounted on the inner wall of the main body 20 are connected with the connecting plate 52 in the semi-annular connect so as to stagger or overlap with the anodes 61 in parallel. An insulated, waterproof and thermal resistant film is coated on the lower surface of the cathodes 51 so as to make the upper surface of the cathodes become a conducting area. On the supported end of the cathodes is provided with packing members 53 made of insulated material. Both the annular connect 39 and the semi-annular connect 38 are connected with a conducting wire 37 respectively.

The adjustable device 80 consists of a first hollow member 83 having female screw 831 provided on the inner wall thereof for positioning an inverted T-shaped member 84 on the protuberance 21 of the body 20, and a second member 81 provided with a cylindrical recess 82 therein having female screw thereon for engaging with external screw provided on outer surface of the cylindrical portion of the inverted T-shaped member 84. The inverted T-shaped member 84 has a longitudinal cylindrical recess provided with female screw thereon for engaging with the external screw 76 of the rotatable shaft 70. The second member 81 is fixed to the inverted T-shaped member 84 by locking means (not shown) after they are engaged. Such that when one rotates the second member 81, in clockwise direction or counter-clockwise direction, the shaft 70 will accordingly move upwardly or downwardly so as to adjust the distance between each pair of corresponding anode and cathode, such that the temperature of the liquid stored within the main body 20 can be adjusted by changing the resistant of the liquid as a result of adjusting the distance between the electrodes.

Fig. 3 shows the anodes 61 mounted on the rotatable shaft 70 not fully staggered or over-lapped with the cathodes 51 mounted on the inner wall of the body 20, under such condition, the adjusting rod 40 may be placed at one end of the semi-circular space 36. In other words, the liquid stored in the body may not be heated when there is not any over-lapping area between the anodes and the cathodes. The over-lapping area of the electrodes may be increased gradually as the adjusting rod 40 is gradually moved to the other end of the semi-circle space 36 (as shown in Fig. 4). The temperature of the liquid will reach the maximum point when the anodes are fully over-lapped or staggered with the cathodes.

It is to be understood that the foregoing disclosure is given by way of illustrative example only, rather than by way of limitation, and that without departing from the principle and scope of the invention, the details may be varied within the scope of the appended claims.

CLAIMS

1. An electric heating apparatus for liquids, comprising a bell-shaped outer housing; a body covered by the outer housing and having an inverted U-shaped sectional configuration;
a base for mounting said body so as to form a closed room having a traversed semi-circular space therein for receiving an adjusting rod which can be moved horizontally within said space, a cylindrical recess provided at the center portion thereof for receiving the lower end of a rotatable shaft and communicating with said semi-circular space, an annular connect provided in said cylindrical recess in intimate contact with said rotatable shaft, and a connecting means for connecting with a conductive plate provided on the inner wall of said body, said adjusting rod being provided with an annular portion positioned in said cylindrical recess for engaging with the lower portion of said shaft, the upper portion of said shaft extending through the central portion of the top of said body and said outer shell, and having external screw thereon;
a plurality of anodes firmly mounted on said shaft;
a plurality of cathodes mounted on the inner wall of said body and connected with said conductive plate; and
an adjustable device moiunted on the central portion of the top of said body and of said outer housing to engage with the upper portion of said rotatable shaft whereby the overlapping area of said anodes and said cathodes will be determined by moving said adjusting rod while the distance between each pair of corresponding anode and cathode will be determined by turning said adjustable device.

2. An electric heating apparatus as claimed in claim 1 wherein the annular portion of said adjusting rod is provided with two catch pawls, and the lower portion of said rotatable shaft is provided with two opposing slots for receiving the catch pawls of the adjusting rod whereby said shaft can be rotated by said adjusting rod and moved in a certain distance in a vertical direction by said adjustable device.

3. An electric heating apparatus as claimed in claim 1 wherein the upper portion of said body is provided with a pipe which

communicates with an outlet of a through way provided in said base.

4. An electric heating apparatus as claimed in claim 1 or 3 wherein said base is further provided with a through way communicating with the lower portion of said body and connected to a water source.

5. An electric heating apparatus as claimed in any one of claims 1 through 4 wherein said adjustable device consists of a first hollow member having female screw therein for positioning an inverted T-shaped member on the central portion of said body, and a second member provided with a cylindrical recess having a female screw thereon for engaging with said inverted T-shaped member.

6. An electric heating apparatus as claimed in claim 5 wherein said inverted T-shaped member has a cylindrical recess therein having female screw thereon for engaging with external screw of the upper portion of said rotatable shaft.

7. An electric heating apparatus as claimed in any one of claims 1 through 6 wherein on the supported end of said anodes and said cathodes are provided with an insulated device so as to avoid shortage when they are energized.

8. An electric heating apparatus substantially as herein described with reference to and as illustrated in the accompanying drawings.

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